Assessment on Kawakawa (*Euthynnus affinis* Cantor, 1849) using data limited approach in the eastern Indian Ocean

Ririk K. Sulistyaningsih[1)], Lilis Sadiyah[1)], Fayakun Satria[1)], Bram Setyadji[2)], Putuh Suadela[3)]

1) National Research and Innovation Agency, Indonesia
2) Student at Liverpool University, United of Kingdom
3) Ministry of Marine Affairs and Fisheries

Abstract

Kawakawa (*Euthynnus affinis* Cantor, 1849) is a significant species targeted by small-scale fishers in the eastern Indian Ocean, specifically using purse seine. However, limited data on this species pose challenges for effective fisheries management. This study aims to assess the stock status of kawakawa in Indonesian waters using Length-Based Spawning Potential Ratio (LBSPR) analysis. LBSPR is a reliable biological reference point often used to guide management decisions in data-limited fisheries. The analysis utilized 7,619 length-frequency data points from kawakawa specimens landed in Fisheries Management Areas 572 and 573. Data were collected monthly from 2015 to 2021, with fish lengths ranging between 25 and 73 cm. The stock assessment was conducted using a length-based spawning potential ratio (LBSPR) method. Results indicated an estimated SPR of 21%, under the management target of 40%. This suggests that the kawakawa stock is currently overexploited in Indonesian waters. Consequently, local authorities may consider advising the fishers reducing their fishing efforts for this species.

Key Words: assessment, kawakawa, Indonesian waters, LBSPR.

Introduction

The kawakawa (*Euthynnus affinis* Cantor, 1849) is a medium-sized pelagic fish species belonging to the family Scombridae, commonly known as the mackerel family. It is widely distributed across the Indo-Pacific region, including the eastern Indian Ocean, inhabiting coastal and offshore waters typically ranging from the surface to depths of 200 meters. Characterized by a robust, elongate body and distinctive oblique dark stripes on its dorsal area, the kawakawa reaches a maximum fork length of approximately 100 cm and a weight up to 14–15 kg. This species is an opportunistic predator, feeding primarily on small fishes, squids, and crustaceans, and often forms large schools with other scombrid species.

Despite its ecological and commercial importance, particularly in multi-species fisheries employing surface trolling, gill nets, and purse seine the population status of kawakawa in the eastern Indian Ocean remains poorly understood due to limited biological and fishery data. Traditional stock assessment methods are often constrained by the scarcity of comprehensive catch and effort records, necessitating the application of data-limited assessment approaches. These methods provide valuable insights into the sustainability and exploitation status of the species, supporting effective management and conservation measures in the region.

The Length-Based Spawning Potential Ratio (LB-SPR) method is a widely used tool for assessing fish stocks in data-poor fisheries, including kawakawa (*Euthynnus affinis*). This

approach relies primarily on length-frequency data to estimate key biological reference points such as the spawning potential ratio (SPR), which reflects the reproductive capacity of the stock relative to an unfished state. LB-SPR is particularly effective in situations where traditional stock assessment data—such as age-structured catch and effort or detailed biological sampling—are unavailable or limited.

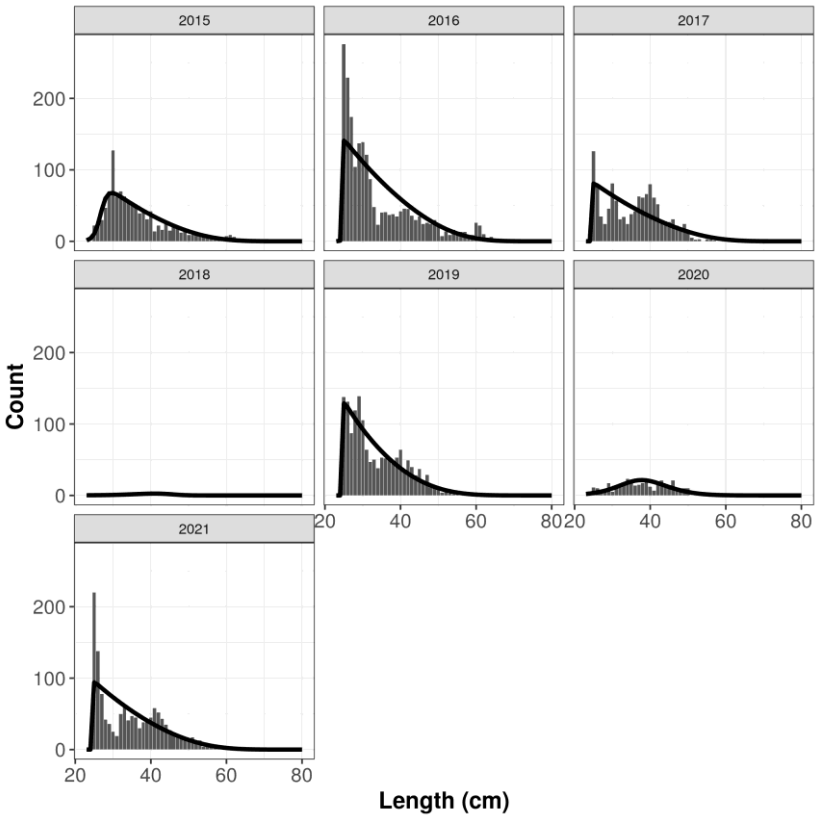
This study aims to evaluate the stock status of kawakawa in the eastern Indian Ocean using a data-limited approach, integrating available biological and fishery information to address knowledge gaps and inform sustainable fisheries management for this important tuna species. The limited data approach for assessing kawakawa (*Euthynnus affinis*) in the eastern Indian Ocean has proven to be a practical and moderately effective method given the scarcity of comprehensive fishery and biological data in the region. Several studies, including assessments by the Indian Ocean Tuna Commission (IOTC), have applied data-poor methods such as the Catch-MSY model and Bayesian biomass dynamic models to estimate stock status using primarily catch and effort data.

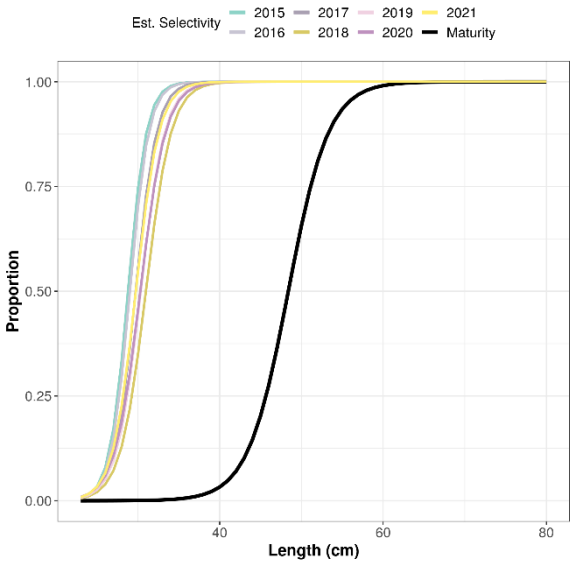
Materials and methods

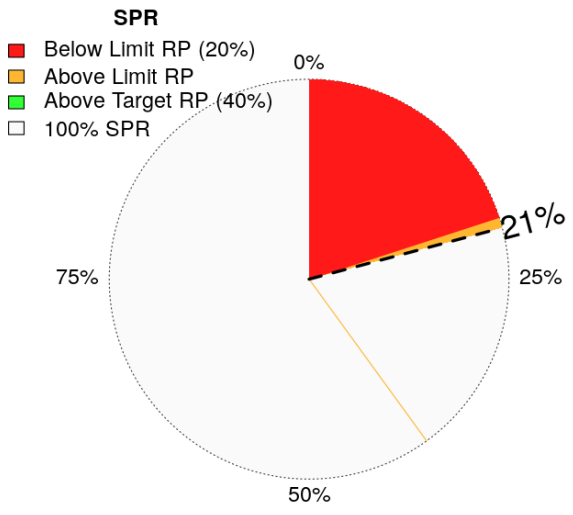
This research was conducted in Fisheries Management Areas (FMA) 572 and 573 within Indonesian waters during the period 2015 to 2021. Sampling involved measuring one fish specimen per metric ton of catch, resulting in a total of 7,619 kawakawa (*Euthynnus affinis*) individuals, with lengths ranging from 25 to 73 cm. Fish length measurements were taken to the nearest centimetre using rulers or callipers at multiple landing sites. Enumerators conducted interviews with fishers, vessel owners, and port officers to complement data collection.

Data analysis was performed using online Shiny app. (http://barefootecologist.com.au/lbspr.html) with grorth parameters: $L\infty$ = 63.5 cm; K = 0.63/yr; t_0 = -0.21 yr, and mortality parameters i.e.: M = 1.07/yr; F =1.33/yr (Jatmiko et al., 2014). Whereas the L_{50} and L_{95} values were recorded as 48.4 cm and 55.7 cm, respectively (Ekawaty and Jatmiko, 2018). The one-fish-per-metric-ton sampling method aligns with practices in data-limited fisheries to provide representative length-frequency distributions for stock assessment. This approach, combined with length-based assessment methods, enabled evaluation of population structure and exploitation status of kawakawa in the eastern Indian Ocean, supporting sustainable fisheries management under limited data conditions.

Results and discussions







LB-SPR methods typically involve fitting length-frequency data to growth and mortality models (e.g., von Bertalanffy growth parameters), estimating the proportion of mature individuals, and calculating SPR to assess whether fishing mortality exceeds sustainable limits. The approach is computationally efficient and adaptable, making it suitable for tropical small-scale fisheries where data limitations are common.

However, LB-SPR assessments do have limitations. They depend on accurate estimates of growth parameters, natural mortality, and maturity schedules, which if uncertain, can affect the robustness of SPR estimates. Additionally, LB-SPR assumes relatively stable recruitment and fishing selectivity, which may not hold in all fisheries. Despite these constraints, LB-SPR provides a valuable, cost-effective framework for generating biological reference points and evaluating stock status in data-poor contexts.

The assessments also highlight significant uncertainties and sensitivities related to assumptions about natural mortality, growth rates, and fishery selectivity, which affect the precision of stock status estimates. The variability in catch data, changes in fishing effort, and lack of standardized CPUE (catch per unit effort) series further complicate assessments.

In the context of kawakawa fisheries, LB-SPR has been applied to estimate population parameters, fishing mortality, and stock status using length composition data collected from landing sites. For example, studies in the Persian Gulf and Sea of Oman have used LB-SPR to reveal high fishing pressure on kawakawa stocks, with spawning potential ratios as low as 20%, indicating overexploitation and disruption of recruitment. These findings underscore the method's ability to detect stock depletion and provide biological reference points that inform sustainable management measures.

In summary, while data-limited approaches for kawakawa assessment in the eastern Indian Ocean are constrained by data quality and quantity, they remain valuable tools that offer consistent and actionable insights into stock status. These methods enable fisheries managers to make informed decisions in the absence of comprehensive data, but results should be interpreted with caution and supplemented with ongoing data collection and integrated assessments for improved accuracy.

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